W/ft^2—Watts Per Square Foot.
W/lin. ft—Watts Per Linear Foot.
W_h—Window Height.
WWR—Window Wall Ratio.
WYEC—Weather Year for Energy Conservation Calculations.

§ 435.100 Explanation of numbering system for standards.

(a) For purposes of this subpart, a derivative of two different numbering systems will be used.

(1) For the purpose of designating a section, the system employed in the Code of Federal Regulations (CFR) will be employed. The number ''435,'' which signifies Part 435, Chapter II of Title 10, Code of Federal Regulations, is used as a prefix for all section headings. The suffix is a two or three digit number beginning with ''.97.'' For example, the lighting section of the standards is numbered § 435.103.

(2) Within each section, a numbering system common to many national voluntary consensus standards is used. This system was chosen because of its commonality among the buildings industry. A decimal system is used to denote sections and subsections. For example, § 9.4.2 refers to section 9, subsection 4, paragraph 2.

(b) The hybrid numbering system is used for two purposes:

(1) The use of the Code of Federal Regulation's numbering system allows the researcher using the CFR easy access to the standards.

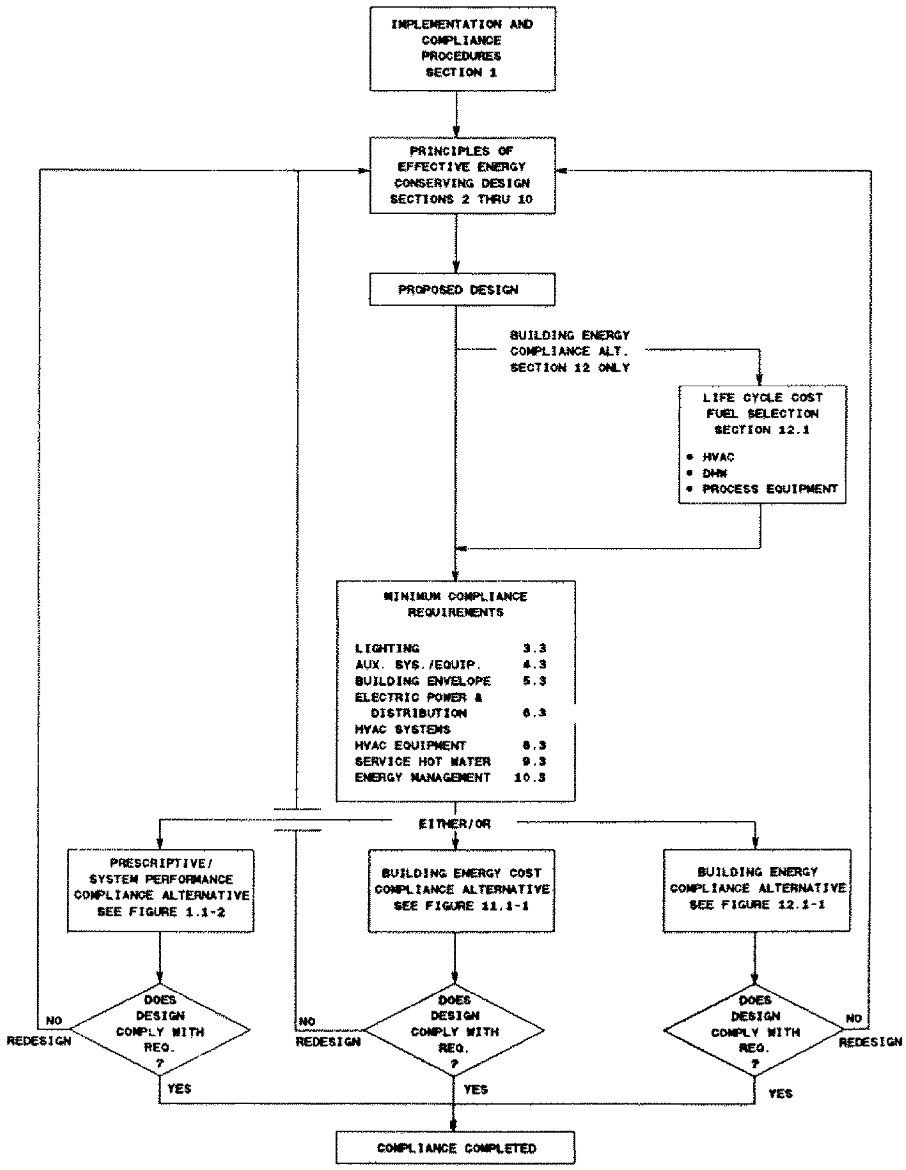
(2) The use of the second system allows the builder, designer, architect or engineer easy access because they are used to the system employed.

(c) To avoid confusion in the use of the two systems, § 435.101 through § 435.112, the substantive technical sections of the standards, have been numbered so that the last two digits in the suffix designate the section. For example, once the reader enters the body of § 435.105: Building Envelope, the number ''5'' is used to designate the section. References throughout the standard do not employ the ''435'' prefix but rather refer to the section by the single or double digit numbers from 1–12.

§ 435.101 Implementation and compliance procedures for Federal agencies.

Alternative methods of achieving compliance are illustrated in Figure 1.1–1.

Figure 1.1-1 Alternative Methods of Achieving Compliance



1.1 Compliance

1.1.1 The head of each Federal agency responsible for the construction of Federal buildings shall adopt such procedures as may be necessary to assure that the design of the building shall:

1.1.1.1 be undertaken in a manner that provides for appropriate consideration of the Principles of Effective Energy Building Design prescribed in §§ 2.0, 3.2, 4.2, 5.2, 6.2, 7.2, 8.2, 9.2 and 10.2;

1.1.1.2 comply with the minimum requirements of §§ 3.3, 4.3, 5.3, 6.3, 7.3, 8.3, 9.3 and 10.3; and

1.1.1.3 meet or exceed, based upon the analysis of life-cycle cost-effectiveness required by § 1.1.2 below, the following additional requirements:

1.1.1.3.1 the lighting design shall meet either the prescriptive requirements of § 3.4 or the system performance requirements of § 3.5,

1.1.1.3.2 the building envelope design shall meet either the prescriptive requirements of section 5.4 or the system performance requirements of section 5.5, and

1.1.1.3.3 the heating, ventilating and air conditioning systems design shall meet the prescriptive requirements of section 7.4, and

1.1.1.3.4 the service water heating systems design shall meet the prescriptive requirements of section 9.4.

1.1.2 In lieu of meeting the provisions of section 1.1.1 above, the building design shall meet the criteria of the building energy method of section 11.0 or 12.0, Building Energy Compliance Alternatives I and II.

1.1.3 The head of each Federal agency responsible for the construction of Federal buildings shall also assure that the decision-making process for the design of the building shall employ the methodology for estimating and comparing the life-cycle cost of Federal buildings and for determining life-cycle cost-effectiveness prescribed in subpart A of 10 C.F.R. part 436.

1.2 General Approach to Compliance

1.2.1 The standards, in addition to minimum requirements, establish three alternate methods to determine whether the design has achieved compliance.

1.2.2 There are several alternative methods of achieving compliance provided for in the standards:

1.2.2.1 Prescriptive (Sections 3.4, 5.4, 7.4 and 9.4),

1.2.2.2 System Performance (Sections 3.5 and 5.5), or

1.2.2.3 Building Energy (Section 11.0 or 12.0).

1.2.2.4 The criteria established for each of the methods allow for designs that are roughly equivalent in terms of energy conservation. The equivalency of the methods can be demonstrated by designing a building using the Prescriptive approach, then modeling the building using either the System Performance or Building Energy criteria calculation procedures and comparing results.

1.2.3 Compliance with these standards shall be demonstrated by meeting the set of minimum requirements defined in Sections 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 7.2, 7.3, 8.2, 8.3, 9.2, 9.3, 10.2, and 10.3 and one of the alternative methods.

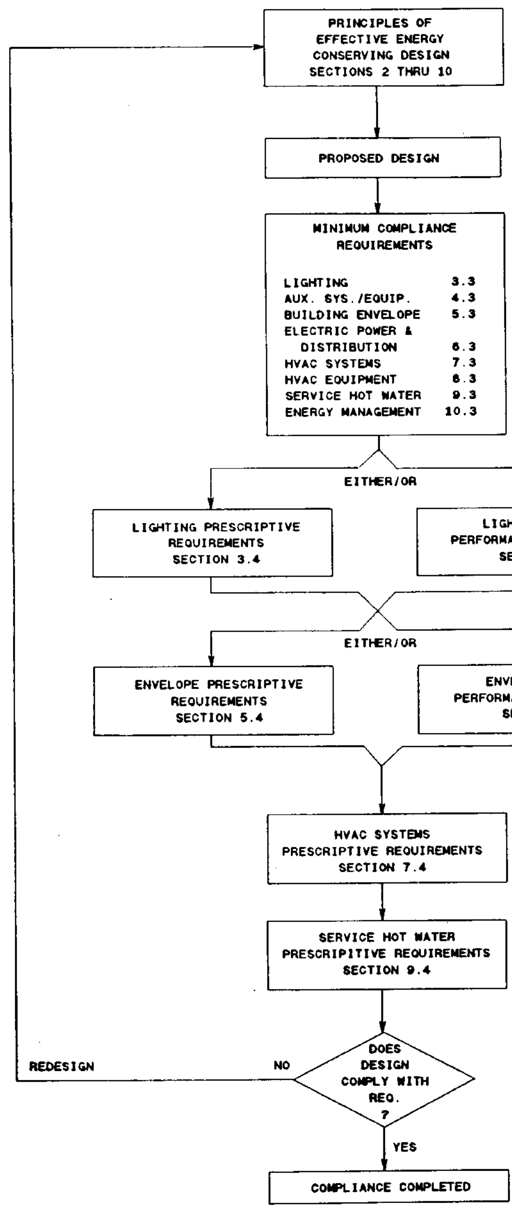
1.3 How To Select a Compliance Method

1.3.1 Use the Prescriptive method when the minimum amount of calculation and effort to achieve compliance is of primary concern. Its requirements can be readily specified in construction documents and are easily reviewed by building code enforcement authorities. The Prescriptive method permits few trade-offs or optimization procedures, but does permit several energy-effective and cost-effective alternate construction options to be used. See Figure 1.1–2.

1.3.2 Use the System Performance method when more innovative design is required, or when the Prescriptive method does not provide the necessary design flexibility. It requires more manual calculations than the Prescriptive method. See Figure 1.1–2

1.3.3 Use either of the Building Energy methods (Sections 11.0 or 12.0) when the most innovative design concepts are being considered. The Building Energy methods allow the trade-off of energy among the building systems as long as the total calculated design annual energy consumption does not exceed the limit prescribed. It will, in general, require the use of a computer program to simulate the operation of the various systems and to model building design energy use in accordance with the building loads and the proposed schedules of operation. See Figures 11–1 and 12–1.

Figure 1.1-2 Prescriptive/System Performance Compliance Alternatives



§435.102 Principles of effective energy building design.

2.1 General

2.1.1 This section complements the other sections of the standards by providing general principles of effective building design. The intention of this section is to provide ideas on how to improve the integration of the building's major energy using subsystems in a cost-effective manner without compromising the building's intended functional use or internal environmental conditions. In addition, more narrowly focused principles are included in sections 3.0 through 10.0.

2.1.2 To comply with the principles of effective design, designers shall use their professional judgment to identify the building's most significant energy requirements and select appropriate solutions from the general strategies found in this section and the more specific strategies found in sections 3.0 through 10.0.

2.2 Identification of Significant Energy Requirements

2.2.1 Before energy design strategies can be developed for a commercial or multi-family high rise residential building, a clear picture of its most significant energy requirements must be developed. The basic approach to achieving an energy conscious design is to improve the energy efficiency of the building by shifting or reducing loads, improving transport systems, and providing efficient environmental systems and controls. This is accomplished by first determining which aspects of the building's energy requirements are the most significant, those that would result in the largest annual energy costs to the building owner if energy conserving strategies were otherwise not applied. For example, for a given building, the largest annual energy cost component may be lighting, followed by cooling, heating, and ventilation, respectively. In this example electricity would be the major energy source. Therefore, peak time-rates of energy use (i.e., peak power demands), as well as direct energy use, would have to be included in any energy analysis. Consideration of peak demands will reduce the requirement for oversizing of energy systems in the building and will also have the added impact of helping to reduce the need for additional, low utilization peak capacity on utility grids.

2.2.2 Once the most significant cost components of the building's energy requirements have been determined, apply the strategies and design solutions listed below and those that appear in each of the following sections of the standards. ln the example noted above, lighting solutions would be addressed first, followed by cooling, heating, and then ventilation.

2.2.3 Research results indicate that the most significant energy uses for any given commercial or multi-family high rise residential building are generally not accurately identifiable by professional intuition. Therefore, use shall be made of one of the several available analysis tools, some of which are microcomputer-based.

2.3 General Solution Strategies

2.3.1 Consider energy efficiency from the initiation of the building design process, since design improvements are most easily and effectively made at that time. Seek the active participation of members of the design team early in the design process, including the owner, architect, engineer, and builder, if possible. Consider building attributes such as building function, form, orientation, window/wall ratio, and HVAC system types early in the design process. Each has major energy implications. These considerations most likely will result in solutions that minimize both construction and operation costs, including energy demand charges.

2.3.2 Address the building's energy requirements in the following sequence: minimize impact of the building functional requirements; minimize loads; improve the efficiency of distribution and conversion systems; and integrate building subsystems into an efficient whole. Each of these is discussed below.

2.3.2.1 Minimize impact of functional requirements by identifying major areas that offer energy efficiency opportunities based on the